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Roles of soil functional microorganisms in enhancing plant salt tolerance

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Microorganisms play a crucial role in aiding pioneer plants or cash crops to establish themselves in heavy-salt stress environments. Soil remediation and plant growth promotion technologies relying on soil functional microorganisms are increasingly under the ecological hotspot. Although we have acquired a substantial understanding of the microbial population structure and evolution in saline-alkali soils, there are still deficiencies in terms of underlying mechanisms and practical applications. We have investigated the community ecology of rhizosphere microbiota associated with pioneer plants in the newly reclaimed saline-alkali soil. We also examined the assembly patterns of core functional microbial communities, interspecies interactions, and the impacts of different plant species on the classification and functional profiles of the microbial community. Soil functional microorganisms were isolated from the plant rhizosphere, and the mechanisms involved in enhancing plant salt tolerance were explored. Many strains were found to promote plant growth and alleviate salt stress damage effectively. Results indicated that beneficial microbes enhance plant salt tolerance by regulating the ethylene pathway and scavenging reactive oxygen species (ROS) in tomatoes, offering new insight into how microbes enhance plant resilience to salt stress. These findings could be leveraged to improve the quality of saline-alkali soils, optimize the micro-habitat and nutrient supply for plant growth, and enhance the salt tolerance of coastal plant species.